PHEV Add-on System User Manual

for 1997-2003 Prius

Warning:

7. **You are strongly recommended to have a qualified professional undertake this installation!**
8. **High Voltage (HV) Direct Current (DC) Warning: Traction battery packs, motors, chargers, and other HV sources could cause serious injury or death if proper precautions are not taken while working on or around such high voltage direct current sources.**
9. **Please note that anyone attempting to install this System and modify their vehicle is doing so at their own discretion and risk.**
10. **Warranty: In performing some of these modifications it is possible though unlikely, to void your warranty with the vehicle manufacturer. Please check with your original vehicle manufacturer / dealer for confirmation.**
11. **This is a patent pending technology.**

Driving Techniques for Maximizing Enginer PHEV Mileage:

1. Maintain as steady speed as possible at all times;
2. When attaining the speed you desire on the road, feather the accelerator or lifting your foot off entirely, then very lightly easing back in to maintain a steady speed of under 34 miles or 70km per hour. That motion activates your Prius EV feature to consume battery power only.

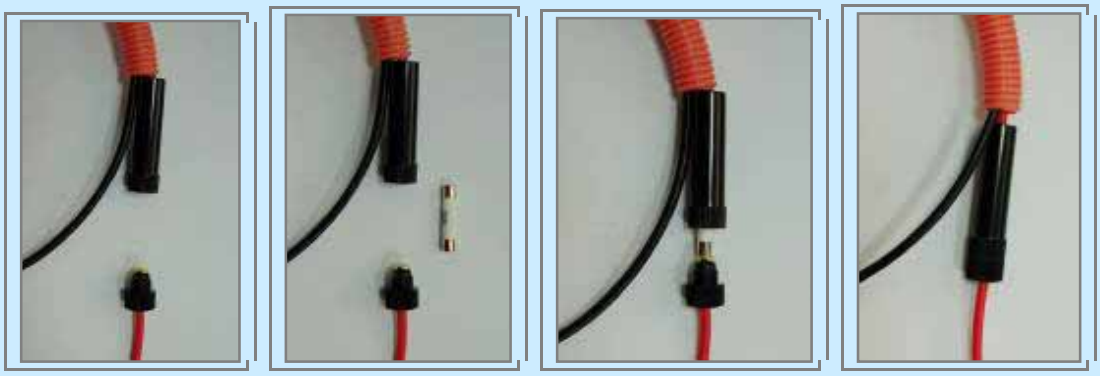
* Tests in this driving style on **Enginer** Prius PHEV have shown way better than 100MPG or 100KM/2.83L, with the best factory field test outcome of 160MPG or 100KM/1.7L for accumulated test drive distance of 165KM.

Attention

1. Please read and follow the instructions before and during installation.
2. Please never connect wires improperly and do carefully check them for at least 3 times before switching the power on.
3. New system batteries should be re-charged to full and well balanced before driving.
4. Please monitor individual cell voltages and balance them regularly.
5. Please make sure the voltage as labeled on the charger matches that from your household electricity source.
6. To extend battery life, the System should be recharged to full each time, especially before the System is to be left unused for over 10 days.
7. To avoid possible battery failure, please turn off the BMS if the System is not to be used for over 10 days.
8. The circuit breaker on the right hand side of the enclosure box will be switched off automatically whenever current exceeds the pre-set limit (125A). In the event that this breaker switches off, you will need to manually press it back on before use. You are suggested to report such errors to **Enginer** or your installer if this keeps happening.
9. Please switch the equipment off immediately if any damage or defect occurs.
10. Please do not disassemble the System if it is working properly and if you are not a qualified professional.
11. Charger and converter fuses can be replaced if blown.

A. **Charger fuse**: Fuse block of the charger is inserted in the AC plug. You can use a flat screw driver to pivot the block in the middle edge, above the fuse sign and pull it outward.

B. **Converter fuse**: The fuse block is connected to the high voltage core. You can open the block and replace the fuse.



User Guide

Enginer Add-on System is designed for PHEV blended mode operation and therefore EV mode switch is not required although it is an option. This PHEV technology minimizes possible impacts on your to preserve your original warranty. The primary goal of the System is to improve fuel efficiency or reduce gasoline consumption.

The PHEV switch should be in the ON position most of the time unless the PHEV red light is ON, indicating low PHEV battery level, or unless you wish to preserve the PHEV energy for later use.

When your vehicle and **Enginer** PHEV switch are both on, the green indicator should also be on, meaning the System is operational. If the red light is on as well, it means PHEV battery low or System error. If the red light stays on all the time, please contact your installer or **Enginer** customer service via Contact Us page on www.Enginer.us.

If your vehicle and PHEV switch are both on but green light is off, please check the System circuit breaker by pressing it off and on again to make sure it is engaged. If problem persists, please seek support from **Enginer** or your installer.

Enginer Battery Management System (BMS) stores diagnostics information on an SD card inside and displays instant performance data on the dash LCD monitor. Please refer to BMS User Manual for details and, when making inquiry, provide **Enginer** or your installer with the SD card data.

To charge the System, it is recommended to use a Gauge #14 extension cord (15A) and plug it into a standard 120VAC/220VAC power outlet with a 20A circuit breaker. Its average current is 10A @120VAC or 5A @220VAC. Once it is plugged in, the external dual color LED indicator should turn solid red. It turns green when batteries are fully charged and the charger stops automatically--No manual shut off is necessary. It takes about 5 hours to charge up from drained. Lithium-Ion batteries should often be charged even if they have not been used up. If the indicator is not on or flashing red check the charger fuse or contact your installer or **Enginer** for advice.

Lithium battery needs to be charged above freezing temperature (32F/0C). If ambient temperature is under freezing point, heating device is needed to avoid permanent battery damage.

With a working PHEV System the Prius Energy Monitor should stay in seven (7) green bars most of the time. If it often shows eight (8) green bars or only six (6) or fewer blue bars, please contact your installer or **Enginer** for advice.

It is recommended to have access to a scan tool such as Scangauge and a wattage monitor like Kill-A-Watt device to monitor and optimize your driving experience with this PHEV System.

Product Overview

The **Enginer** PHEV Add-on System is a rechargeable battery set that supplements Prius OEM battery. The System supplies stored electricity which was previously charged from an AC wall socket, providing 40 miles of electrically assisted driving distance per charge, sufficient for most daily commutes. It is safe, reliable and user-environment friendly.

What is Included in this Product

- ☐ 4KWH Lithium-Ion batteries
- ☐ BMS—monitoring and balancing batteries to avoid individual cells over charge / discharge, extending battery life.
- ☐ 110VAC - 48VDC / 15A high power charger.
- ☐ 5KW DC / DC converter and controller.
- ☐ Fire extinguisher will be activated once the inside temperature exceeds 221F—First of all, please remove the cover and pull out the blue isolation inserter.
- ☐ Automatic DC circuit breaker—to disconnect high voltage equipment operation in the event of a high current fault.
- ☐ Steel enclosure.

How the System Works

110VAC (USA) household electricity → Enginer PHEV Add-on System → Prius OEM stock battery → Jointly drive Prius electric motor.

Batteries	Type	Capacity	Average Gas Mileage	EV/Mixed Range	Charge time
	Lithium-Ion	80 AH	70 mpg	20 (40)	5 hours

- **Use 110V AC source (USA, or other AC source matching PHEV charger) only**.

Warranty

Two-year limited parts warranty applies. If equipment defect occurs in normal use conditions, **Enginer** shall repair the equipment or change the defective component in this System only.

Use this information at your own risk: Other than as specified above there is no additional warranty expressed nor implied and **Enginer** shall not be liable for any of your past, present, nor future actions. Even if you perform these modifications to the latter you could still damage any number of components in your vehicle causing it to no longer functional. Even if it appears to function properly, your actions may cause it to self destruct with collateral damage to surrounding properties other than your vehicle. By utilizing these ideas and instructions in an attempt to enhance national security, reduce gasoline consumption, vehicle emissions, your carbon footprint, or smog, you do so at your own risk & peril.

Contacts

US Distributor: **Enginer, Inc., Michigan, USA**
Web: www.**Enginer**.us
Email: CS@**Enginer**.us
Toll Free: 877 886-8897
Address: P.O. Box 3, Troy, MI 48099, USA

Manufactured By: **Enginer, Inc. Shanghai**
Address: 111 / 7580 Humin Road, Shanghai, China, 201102

Preparing and Assembling Enginer PHEV Add-on System

Please carefully read and understand these instructions before opening the product container.

Installation and Use

1. Prepare a flat area of at least 7x7 feet on the ground near the end of your Prius, and cover the floor with a 5x5 feet soft and flat cloth or cardboard.
2. The equipment is heavy and should be removed and carried by at least two adults. As industry standard it is suggested that the System should be handled by a lifting machine.
3. Knock open the wooden box, if there is one, and then open the cardboard box in-side.
4. Take out accessories and place them in a place not impeding your later installation. Take out the foam plastic cover from the cardboard box and pull out the steel box (this requires at least two people with both hands) carefully and steadily move out the entire steel box and place it gently on the floor. Do not tilt or turn over the equipment.
5. The equipment weights about 180 lbs. **Enginer** strongly suggests you use professional lifting equipment, or operators that are strong enough to lift this much weight. Move the equipment slowly and carefully to avoid physical injury or equipment damage.
6. After popping up the cover firmly and checking that it is safe with no risk of dropping down, gently take out all insulating foam and check inside component and accessory bags against the following list:
   - ECU signal wires (green, brown and white)
   - One switch panel with On / Off switch, red and green LED lights
   - 6 pin phone wire
   - Converter high voltage core (red and black core with blue bullet connectors)
   - Power core for charger input
   - 2 sets of equipment mounting screws (size M8)
   - One charger input bumper socket
   - One double-sized spanner
   - One thread for converter and charger
   - 4pcs plastic clamps for connecting ECU signal wires to Prius
   - Two black rubber blankets, the longer one for left hand side, shorter one for the right hand side.
   - One 50cm long vent pipe for left hand size corner ventilation fan
   - 1:1 mounting hole positions template.
   - Steel box and cover (833 x 505.5 x 152mm)
   - Batteries: 4KWH in 2 packs. Please make sure batteries match your order.
   - One DC-DC converter mounted back left, with a pair of red and black power inlet cores, ending with an Anderson plug to battery packs. It also contains a pair of power outlet (red and black) and a 6 pin cable.
   - One power charger mounted on right back, with a black power inlet cable on right hand side and a pair of outlet cores (red and black) on left, linking an Anderson plug
   - BMS mounted above the power charger (the side close to your body).
   - Two ventilation fans attached on left top of the converter.
   - One circuit breaker mounted on a side of the charger.
   - One fire extinguisher fixed in the middle of the System and in between of the 2 battery packs.

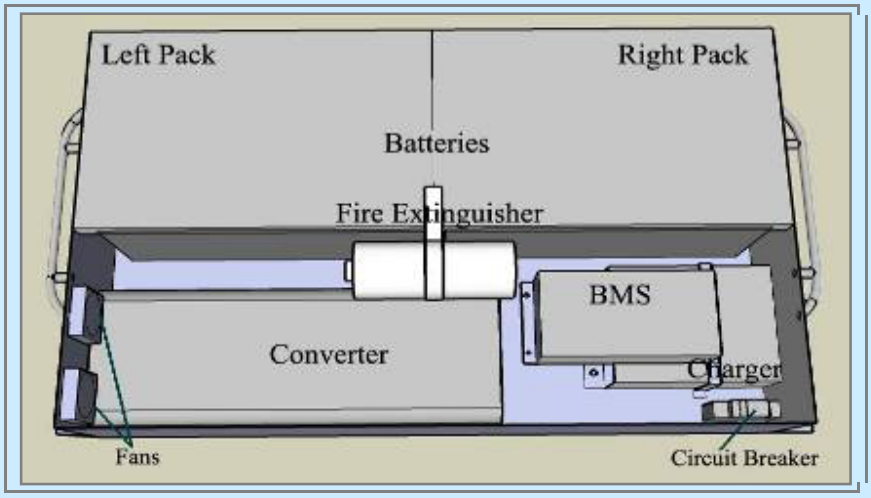


Figure 1: Component Layout

7. Wiring Check: ① Make sure circuit breaker is in the OFF position, BMS' interfaces off; ② Charger and converter connections are appropriate, solid and firm; ③ Black cores from batteries and to circuit breaker are connected correctly and firmly as shown below:

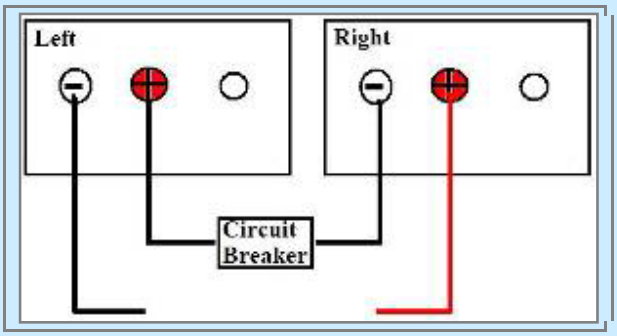


Figure 2: Connection of batteries (4KWH)

8. Wiring: ①Connect the Anderson plug labeled "**R**" to the "**R**" (Right) battery pack, and "**L**" to the "**L**" (Left) pack; ②Insert the "**R**" battery 9 pins white plug into the "**R**" connector on BMS, and the "**L**" one to "**L**" connector; ③Plug the 8 pin wire into BMS; ④Firmly link the high voltage cores (red and black cores with blue bullet connectors) with the converter output connectors; ⑤Plug in the 6 pin phone wire to the converter.
9. System assembly is completed and ready to be installed into your vehicle.
10. Bumper outlet for charger connection. Black wire = Live line (L); White wire = Null Line (N); Green wire = Ground Line (E). Take the charger core through the back panel and reach to bumper outlet. You need to get your hand in from under the car and tighten the silver ring of bumper plug.

11. Install the Charger LED into the tail-light, this LED shows charger operation:
Red LED: Charging at about 15A.
Green LED: Fully charged.

12. PHEV switch panel operation:
ON：Turn on PHEV DC/DC Converter (LED Green---On; Red—Low Battery)
OFF：Turn off PHEV DC/DC Converter (LED Off).

Connecting Enginer PHEV Add-on System to your Prius

Installation Time: 4 hours by professionals.
Before installation, please login to Toyota Technical Website techinfo.toyota.com for Reference Instructions. ($15 for two day usage as of June 2009)

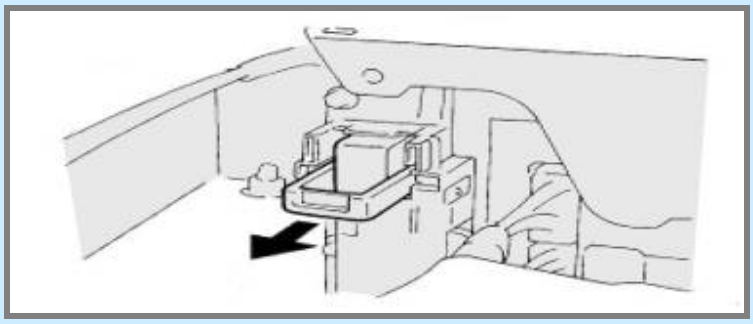
Preparation tools required:

Screw shell M6~M14

Crosshead screwdriver

Electric drill

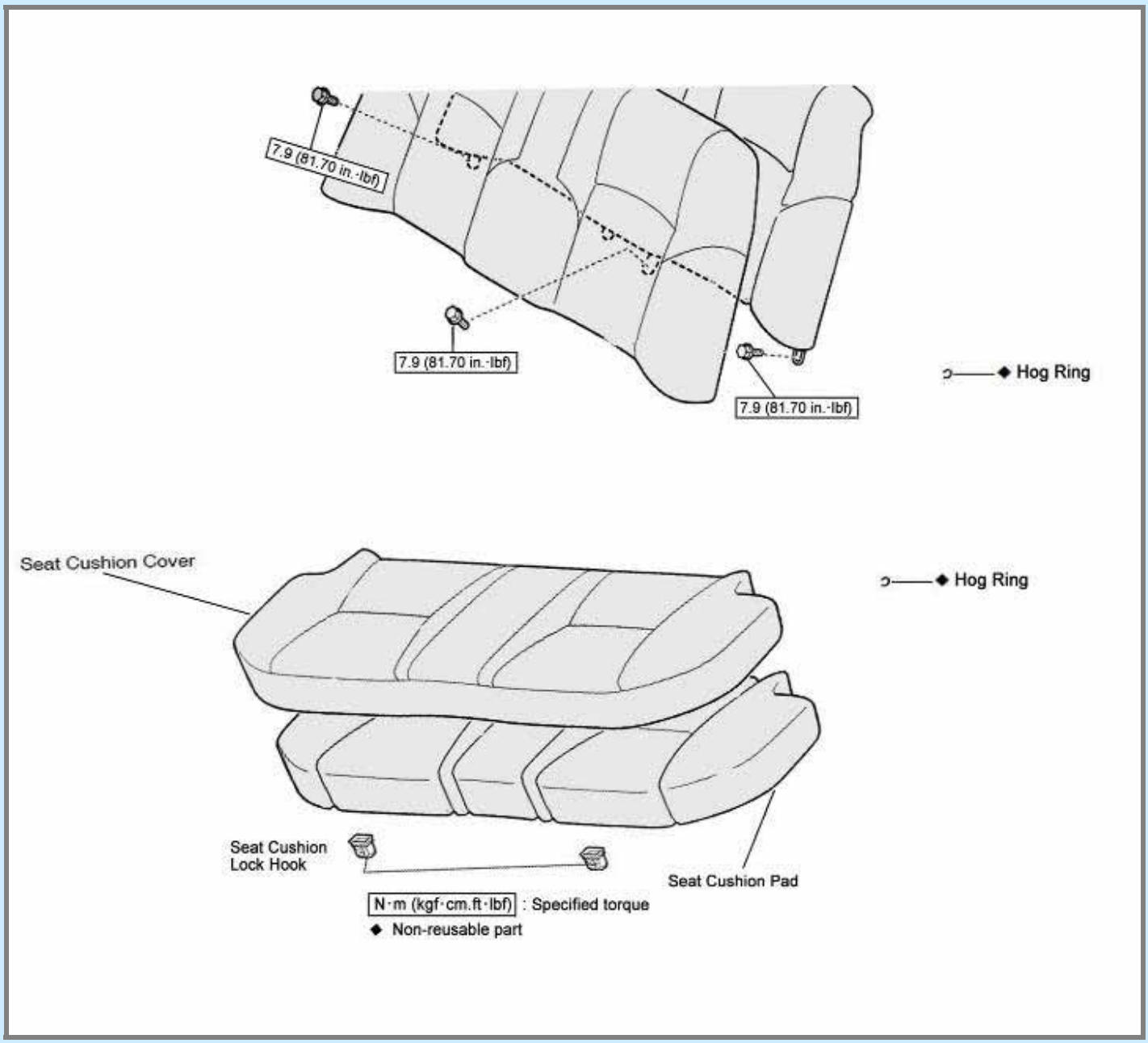
Installation Procedure:
1. Stop your Prius engine completely by taking away your car key.
2. Remove trunk interior cover on the back of the back seat to gain access to and unplug the orange OEM stock battery service plug.

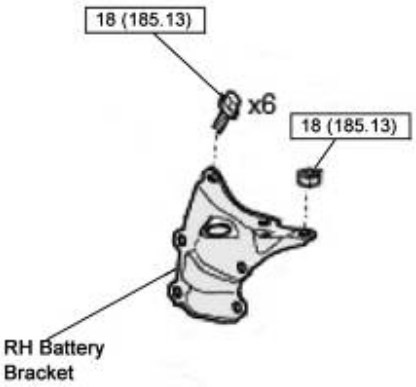


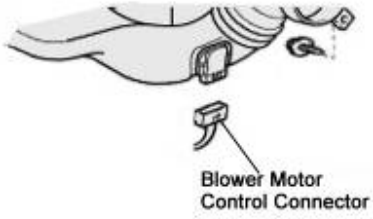
3. Remove auxiliary battery negative terminal.
4. Remove back seat and gain access to the OEM stock battery output terminals.

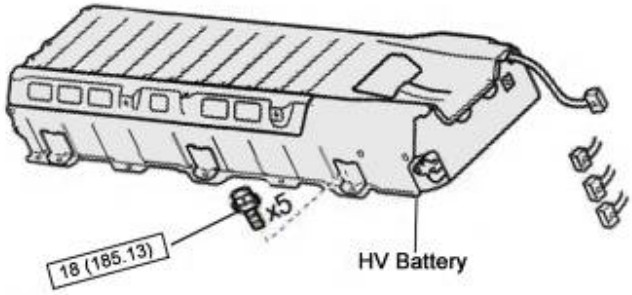
Reference: HV-4 HYBRID VEHICLE CONTROL − HV BATTERY (for 2000-2003 Prius)

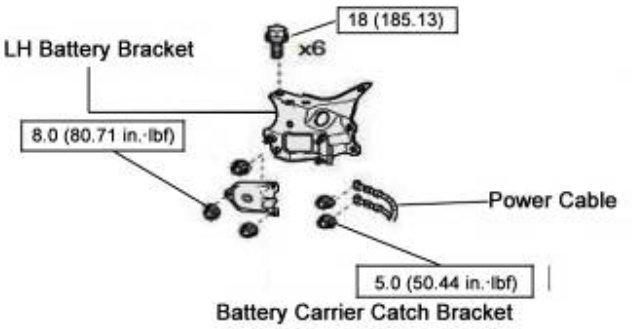
A. Pull up the seat cushion pad front edge toward back.
B. Remove back cushion screws and pull it up.
C. Remove battery carrier catch bracket to access to power cable terminal. The upper terminal is positive, the lower is negative.

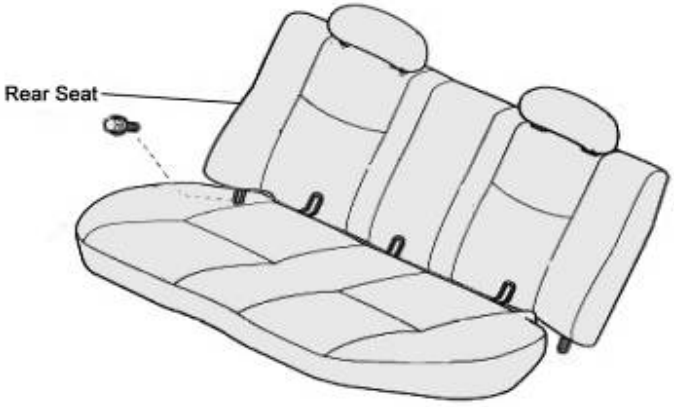


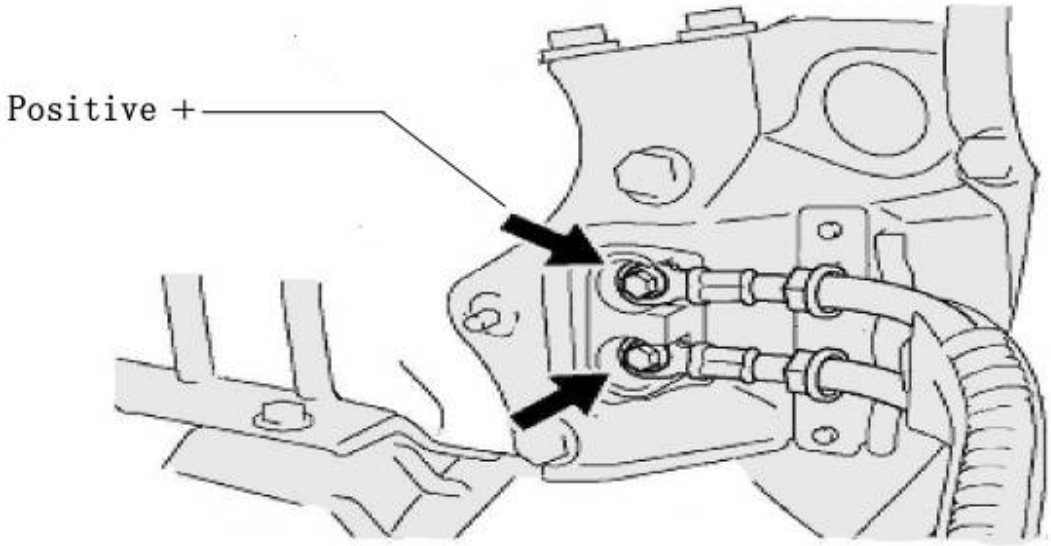

18 (185.13)
x6
18 (185.13)
RH Battery
Bracket


Blower Motor
Control Connector


x5
18 (185.13)
HV Battery


LH Battery Bracket
18 (185.13)
x6
8.0 (80.71 in.·lbf)
Power Cable
5.0 (50.44 in.·lbf)
Battery Carrier Catch Bracket


Rear Seat


Positive +

5. Connect the System power cable to positive and negative terminals of the stock battery output power cable.

6. Install on/off switch panel.

A. Take off the blank panel on the left hand side of your meter board

B. Loosen the switch bolt, place it on through the panel hole and tighten it on the panel.

Before replace panel:

After replace panel:

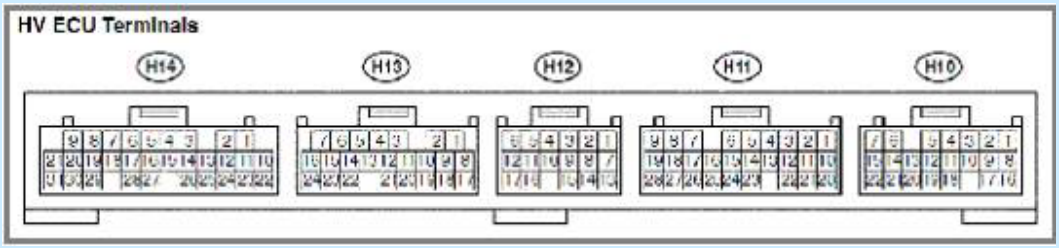
7. Hook up ECU Ignition Ready signal to on/off switch panel.

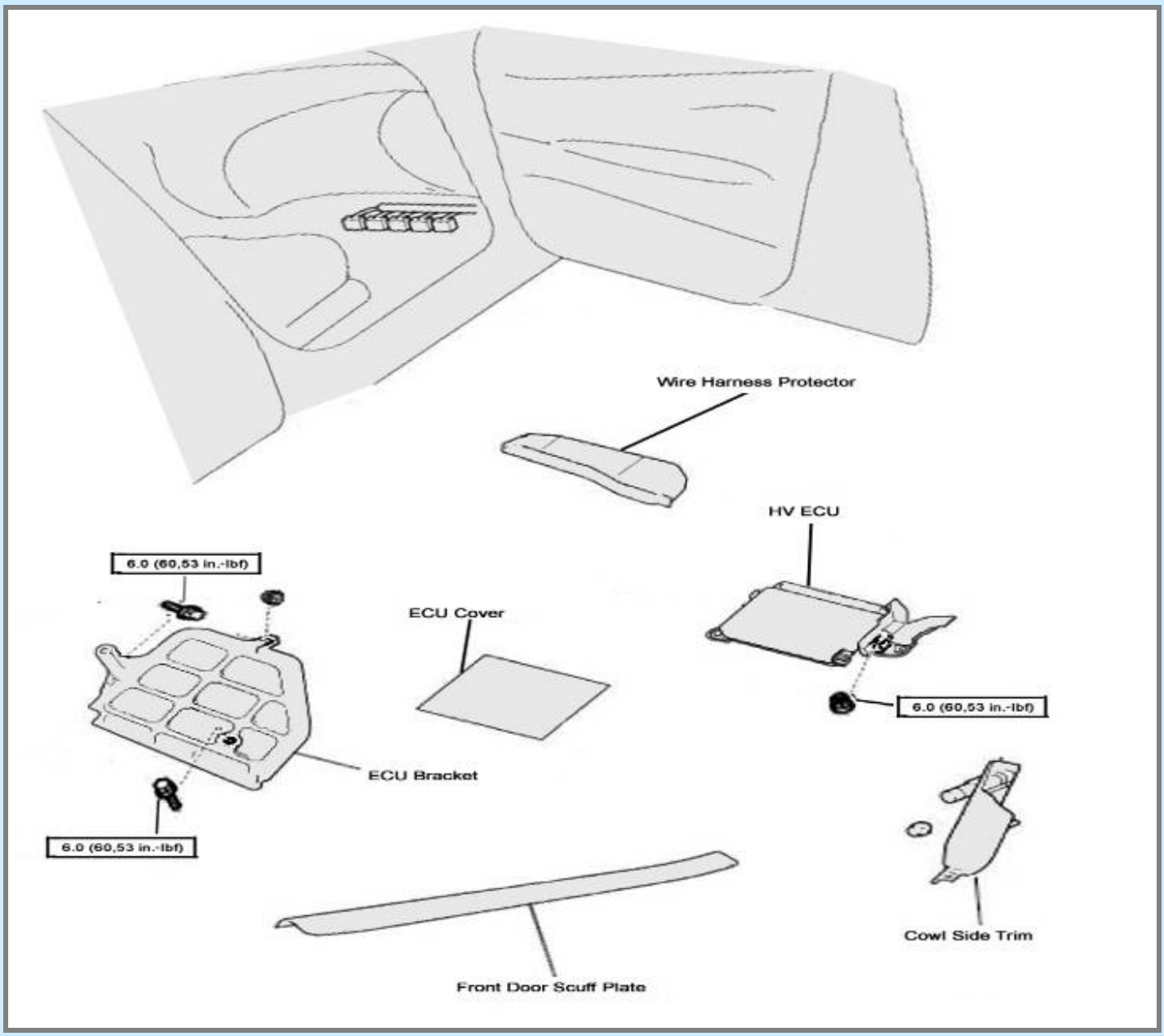
Reference: DI-20 Terminals of ECM (for 2000-2003 Prius)

CON2 (H12-2) −Grey: Ignition Ready (Connect to the Green wire of PHEV switch panel)

GND1 (H14-31) - White/Black: Ground (Connect to the Brown wire of PHEV switch panel)

- **White wire is not connected for 2000-2003 Model**





8. Hook up 6-Pin On / Off switch panel cable to your **Enginer** battery box.
9. Drill a hole and mount Bumper AC Outlet
10. Recover back seat and trunk panels. Reposition the Service Plug Grip firmly before electric power resumes.

Your Enginer PHEV Add-on System installation is now complete.

Please test the equipment in the following steps:

1. Turn the **Enginer** circuit breaker off.
2. Disconnect the converter high voltage output to the OEM battery (red and black wires with blue bullet connectors).
3. Start your vehicle.
4. If the vehicle does not start with the Check Engine light on, do step 5-8.
5. Check Toyota battery orange high voltage service plug to ensure it is plug in correctly, locked and secured.
6. Check splice wires to make sure the connectivity is not compromised and the wire is correct. Splice may occasionally cut off the original wire.
7. Use scan tool to reset Error Code or disconnect the 12V battery and wait for 15 minutes to reset the Error Code.
8. Re-check your vehicle and confirm it is operational.
9. Turn on **Enginer** PHEV circuit breaker while keeping HV output wires disconnected.
10. Start your vehicle.
11. Check if **Enginer** PHEV switch panel is only green light on when the switch is at ON position. Also check the light on the converter output panel in the battery box.
12. If the green light is not on, use a meter to check if the Ignition 12V signal is 12V on the PHEV switch panel. Also check the phone cable connector on the converter side to make sure pin 5, 6 have 12V signal.
13. Check OEM battery high voltage. Pay attention to the polarity of the wire.
14. Check PHEV converter output high voltage. Pay attention to the polarity. The voltage should be 5-10V higher than the OEM battery voltage.
15. Turn off the car before connecting the converter high voltage to the OEM battery.
16. Turn on the car in Park, check PHEV battery voltage which should drop 1-5V when charging the OEM battery.
17. If the PHEV voltage drops more than 5 volts, check individual cell voltages to locate weak cell (s) that is / are significantly lower than the peer.
18. Charging batteries.
19. Wait overnight for the cells to be charged and balanced.

Final Stage: Mounting Your Enginer PHEV Add-on System:

A. Mark eight mounting holes according to size and dimension of the System's mounting brackets.

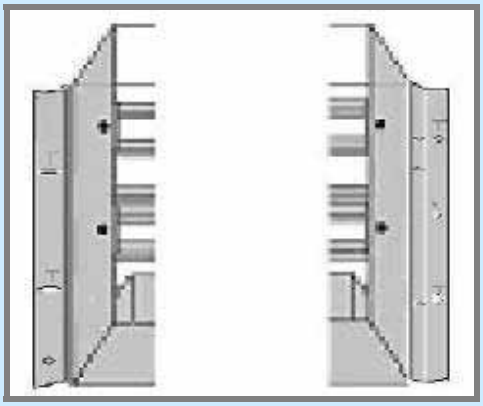
B. Drill two 13mm holes on the middle left of trunk floor plate all the way through the frame and three 13mm holes through the sheet metal.

C. Put the rubber blankets under the brackets (the long one for left bracket, the short one for the end of right bracket).

D. Tighten five mounting screws with washer and spring ring.

E. Remove implements on the left side of trunk and put the vent pipe for circulating air inside PHEV.

F. Tighten buckles on two sides of the enclosure box to mount the entire equipment.

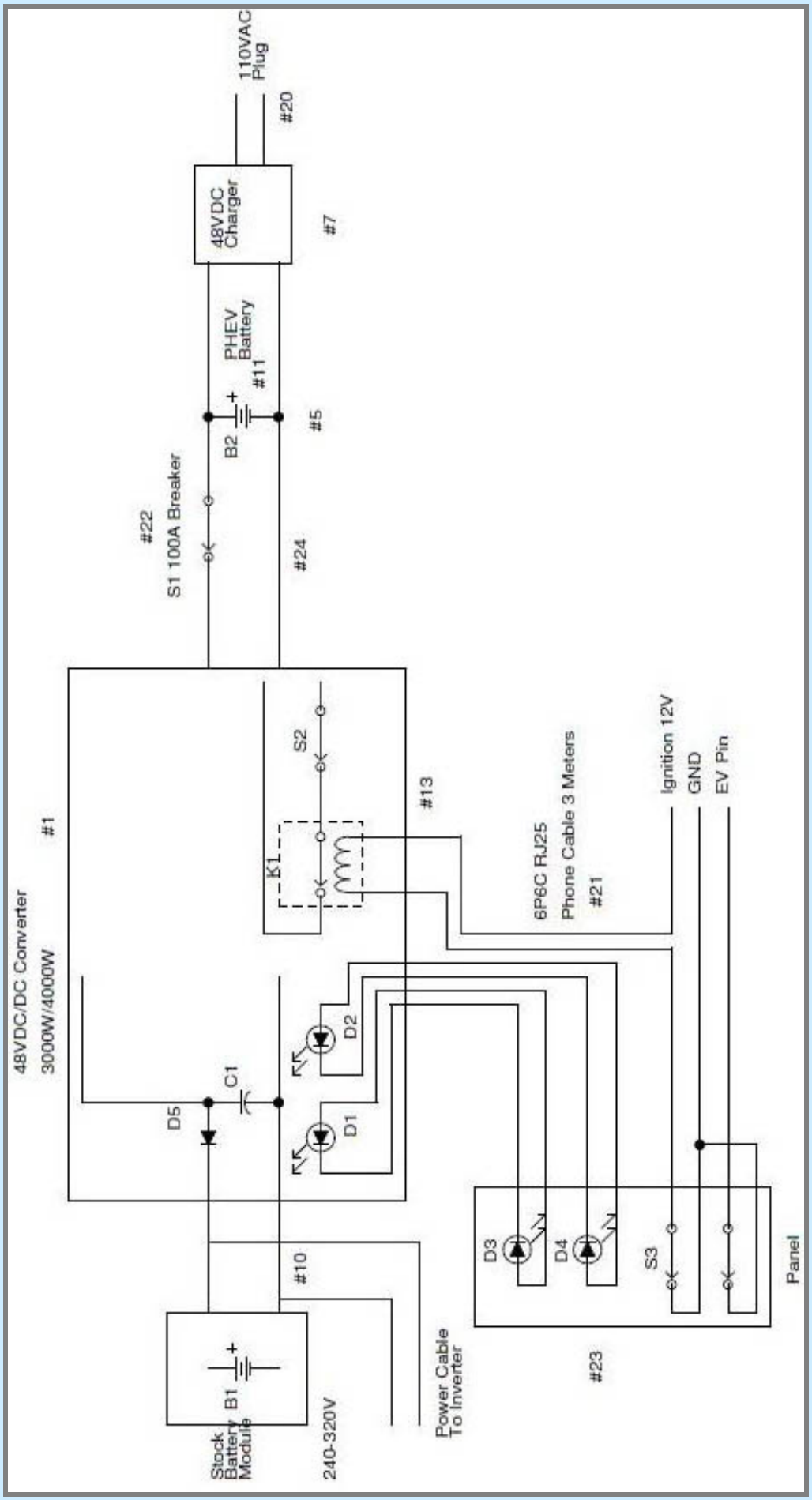


Once all the above steps are completed and no defect occurs, so tighten two screws on both sides of the steel lid, you are now safe to drive your Enginer Plug-in Hybrid Electric Vehicle!

Please dial Enginer Assistance Hotline at 877-886-8897 if you encounter difficulty or risk during and after installation.

Enginer appreciates your efforts to save our environment

and wishes you safe and enjoyable driving with your new PHEV!


110VAC Plug
#20
48VDC Charger
#7
PHEV Battery
#11
B2
#5
#22
S1 100A Breaker
#24
S2
K1
#13
6P6C RJ25
Phone Cable 3 Meters
#21
Ignition 12V
GND
EV Pin
48VDC/DC Converter
3000W/4000W
#1
D2
C1
D5
D1
D3
D4
S3
Panel
#10
#23
B1
Stock Battery Module
240-320V
Power Cable To Inverter

NOTE: